

# (12) UK Patent Application (19) GB (11) 2 181 084 (13) A

(43) Application published 15 Apr 1987

(21) Application No 8622861

(22) Date of filing 23 Sep 1986

(30) Priority data

(31) 60/219956

(32) 2 Oct 1985

(33) JP

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(51) INT CL<sup>4</sup>

B23K 1/02

(52) Domestic classification (Edition I):

B3R 113 300 DP

(56) Documents cited

None

(58) Field of search

B3R

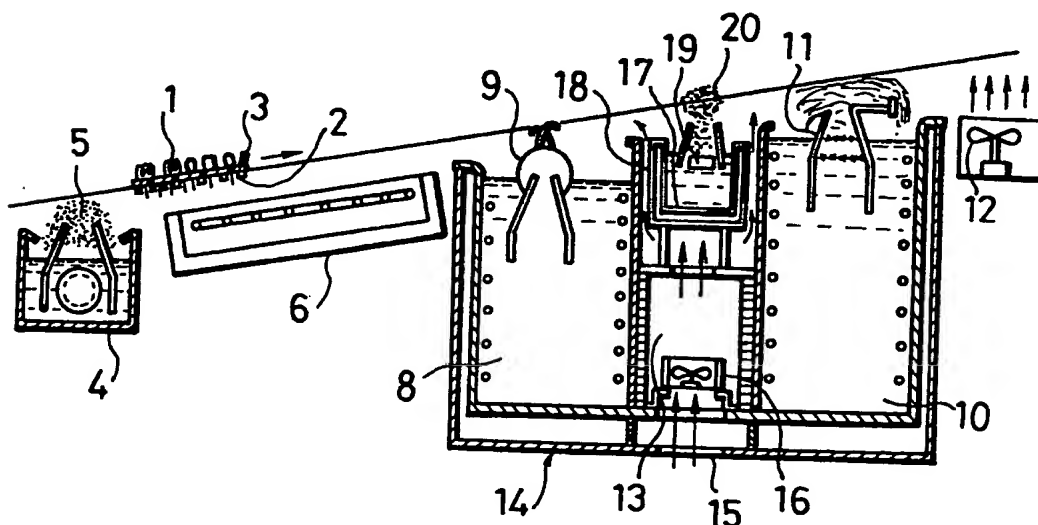
Selected US specifications from IPC sub-class B23K

(54) Soldering apparatus

(57) Soldering apparatus for soldering a printed circuit board (3) carrying electronic parts (2) has a primary fluxer (5), a preheater (6), a primary solder bath (8), a secondary fluxer (13) and a secondary solder bath (10) all arranged in line such that the secondary fluxer (13) lies between the primary and secondary solder baths (8 and 10).

The provision of the secondary fluxer (13) and the secondary solder bath (10) is to remove undesirable solder stalactites and solder bridges.

Fig.1



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Fig.1

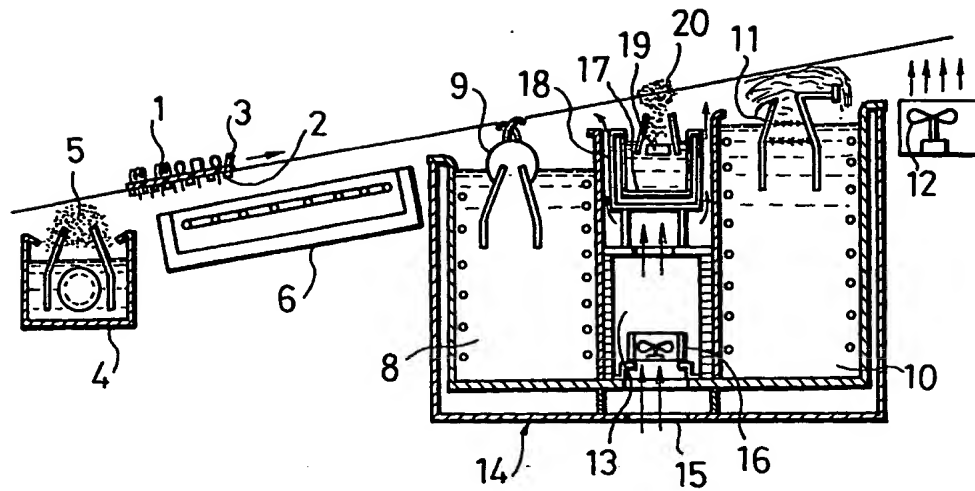
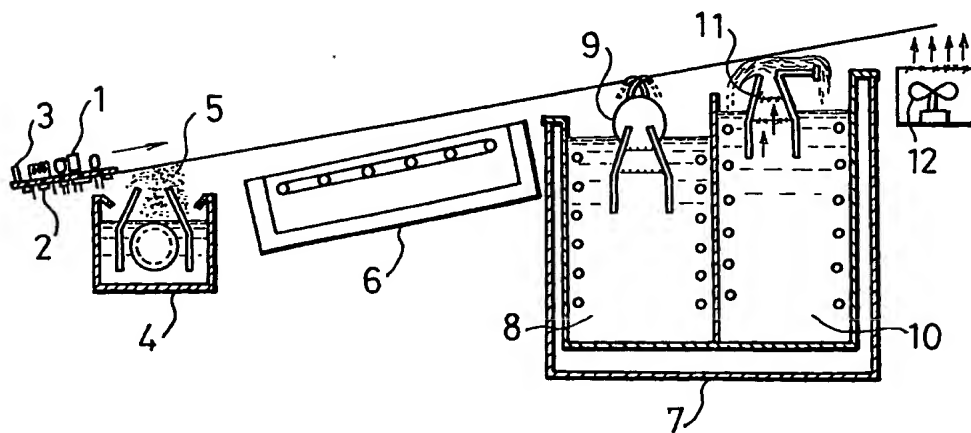


Fig.2  
PRIOR ART



## SPECIFICATION

### Soldering apparatus

- 5 The present invention relates to soldering apparatus.

Such soldering apparatus may be used for soldering a printed circuit board and, may take the form of a continuous soldering apparatus which is suitable for continuously soldering a printed circuit board having chip parts or the like packaged therein in a high density.

It is an object of the present invention to provide a improved soldering apparatus.

- 15 According to the present invention, there is provided an apparatus for soldering a printed circuit board having electronic parts packaged therein, comprising: a primary fluxer for applying post-flux to said printed circuit board; a preparatory heater arranged downstream of said primary fluxer for evaporating the solvent of said post-flux and for preheating said printed circuit board to soften the heat shocks; a primary solder bath arranged downstream of said preparatory heater and having a primary sprayer for spraying solder to said printed circuit board; and a secondary solder bath arranged downstream of said primary solder bath and having a secondary sprayer for spraying solder to said printed circuit board once soldered, wherein the improvement comprises a secondary fluxer interposed between said primary and secondary solder baths for applying mist of flux to the lower side of said printed circuit board once soldered.

The secondary fluxer is arranged upstream of the secondary solder bath again the flux to the printed circuit board, which has been subjected to the primary soldering in the primary solder bath and then heated, so that the printed circuit board is finished in the secondary solder bath after it has been preheated to have its solvent evaporated by the upstream and downstream solder baths. As a result, the slug left on the surface of the secondary solder bath is removed by the effect of the flux applied again, and the activation by the flux continues while the board is being dipped in the secondary solder bath. The flux thus applied is gasified by the heat of the solder to clear the board of the ambient air so that the board surface wetted with the solder is kept non-oxidized to form clear fillets.

- 55 Soldering apparatus embodying the present invention, will now be described by way of example with reference to the accompanying diagrammatic drawing, in which:

Figure 1 is a longitudinal section through the soldering apparatus embodying the present invention; and

Figure 2 is a longitudinal section through a previously proposed soldering apparatus.

Fig. 2 shows a previously proposed printed-circuit board soldering apparatus. A printed

circuit board 3 carrying electronic parts 1 with leads and chip parts 2, as shown in longitudinal section, is wetted with post-flux 5 by a primary fluxer 4 of the foaming type and is preheated by a pre-heater 6 to evaporate the solvent in the flux and to soften the heat shocks.

- Next, a high-wave solder is sprayed from a primary wave sprayer 9 in a primary solder bath 8 of a solder bath body 7 such that it may not fail to wet the part by preventing air from being stagnant on the part. However, the solder application by the primary wave sprayer 9 forms high waves on the surface of the molten solder so that solder stalactites and/or solder bridges frequently develop from the high waves. In order to eliminate the stalactites and bridges of the solder, therefore, a secondary soldering is performed in a secondary solder bath 10 by a secondary wave sprayer 11, and the molten solder surface having less waves is pulled up to reduce the developments of the stalactites and bridges. During the primary soldering, however, the flux is removed by the high-wave solder, or its active agent is damaged by the heat to reduce the fluxing effect. The part thus soldered is complete after it has been cooled by a blower 12. The soldering steps thus far described are conducted in a continuous manner.

The following problems arise if a printed circuit board having a higher package density is to be soldered by this soldering apparatus.

- (1) Insufficient soldering is caused frequently by the solder stalactites and bridges and is difficult and inefficient to repair because the printed circuit board is small-sized and package density is high.

(2) The repairer has to resort to a soldering iron to extend the heating time period thereby to cause secondary problems in that the parts are thermally damaged or in that the printed pattern and/or chip parts have some of their silver electrodes melted away.

- 110 In the apparatus shown in Fig. 1 parts similar to those in Fig. 2 are similarly referenced. The apparatus of Fig. 1 is similar to the apparatus of Fig. 2 except that a secondary fluxer 13 is interposed between the primary solder bath 8 and the secondary solder bath 10. A solder bath body 14 incorporates the primary solder bath 8, the secondary solder bath 10 and the secondary fluxer 13. This fluxer 13 is arranged centrally of the solder bath body 14 and has an opening 15, which is formed in a lower portion of the solder bath body 14, and a blower 16 which is positioned above the opening 15. Air is blown around a double-boxed flux bath formed by inner and outer boxes 17 and 18 partly to reduce the temperature of the molten flux and partly to prevent heat transfer by convection of the heat liberated from the primary and secondary solder baths 8 and 10. The secondary flux bath 13 is equipped therein with a spray mist genera-

tor 19, which operates to spray a mist 20 of the flux into the underside of the printed circuit board when a detector (not shown) detects the approach of the printed circuit board.

5 The following effects can be achieved by the described apparatus.

(1) A high dense package can be soldered with less solder stalactite and bridge defects.

10 (2) Because of the resulting reduction in the number of parts to be repaired, the risk of a secondary defective is accordingly reduced, and the silver electrodes of the printed patterns and chip parts are less molten away.

(3) It is possible to provide a soldering 15 apparatus having an excellent production efficiency.

#### CLAIMS

1. Apparatus for soldering a printed circuit 20 board carrying electronic components, the apparatus, comprising:

a primary fluxer for applying post-flux to said printed circuit board;

25 a preheater arranged downstream of said primary fluxer for evaporating the solvent of said post-flux and for preheating said printed circuit board to soften the heat shocks;

30 a primary solder bath arranged downstream of said preparatory heater and having a primary sprayer for spraying solder onto said printed circuit board; and

a secondary solder bath arranged downstream of said primary solder bath and having a secondary sprayer for spraying solder to 35 said printed circuit board once soldered, and a secondary fluxer interposed between said primary and secondary solder baths for applying a mist of flux onto the solder deposited on the printed circuit board by the primary solder bath.

40 2. Apparatus according to Claim 1, wherein said primary solder bath, said secondary fluxer and said secondary solder bath are accommodated in a common solder bath body.

3. An apparatus according to Claim 1 or to Claim 2, wherein said secondary fluxer includes: a flux bath containing flux therein and positioned in an upper portion of said solder bath body; an opening formed in a lower portion of said solder bath body below said flux bath and a blower positioned above said opening for directing a stream of air upwardly around said flux bath to reduce the temperature of the molten flux and to reduce heat 55 transfer to the flux bath from said primary and second solder baths by convection.

4. Apparatus according to any one of Claims 1 to 3, wherein said secondary fluxer 60 further includes a spray mist generator for spraying the flux in the form of mist from said flux bath onto the underside of said printed circuit board.

5. Apparatus according to Claim 3, 65 wherein said flux bath has an inner and outer

spaced walls.

6. Apparatus according to any preceeding Claim further comprising a blower arranged downstream of said secondary solder bath for 70 cooling said printed circuit board.

7. Apparatus for soldering a printed circuit board substantially as hereinbefore described, with reference to Fig. 1 of the accompanying drawings.

Printed for Her Majesty's Stationery Office  
by Burgess & Son (Abingdon) Ltd, Dd 8991685, 1987.  
Published at The Patent Office, 25 Southampton Buildings,  
London, WC2A 1AY, from which copies may be obtained.